

It was at the Paris meeting of 1907 that the name *International Meteorological Organization*³ was first defined as consisting of—

1. Conference of directors.

2. The International Meteorological Committee.
3. Commissions.

The International Meteorological Committee continues to function, as in the past, as the executive committee of the conference of directors the body as a whole being known as the International Meteorological Organization.—A. J. H.

THE INTERNATIONAL CONVENTION FOR SAFETY OF LIFE AT SEA, LONDON, 1929

By E. B. CALVERT,¹ Chief of Forecast Division

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There were two international conventions held in 1929 which resulted in agreements of high importance to meteorology. The first of these, the International Convention on Safety of Life at Sea, was held in London from April 16 to May 31. On the latter date it was signed by the delegates of the 18 maritime nations that were represented. No nation failed to sign. In all there were 172 officially appointed delegates and experts, and a considerable number of advisors not included in the delegations. These statistics are mentioned merely to indicate the magnitude of the assembly and its importance. It was the second international conference of its kind, the first having been held in 1914 as a result of the *Titanic* disaster.

Meteorology had small part in that first conference in 1914. Scarcely could it be said that "it was among those present." As a matter of fact, so far as can be ascertained, no meteorologist was in any national delegation. Nevertheless, it must have been recognized that weather is a menace to safety of navigation with which ships must contend because several pages of the convention as signed were devoted to meteorology but in a form that placed no obligation on ship masters to furnish weather reports. It consisted of codes, tables, and generalizations which were of no use to anybody and in fact were obsolete by the time the convention articles were published.

Meteorology had a far different status in the 1929 convention. This was due in considerable part to the International Meteorological Committee, aided in some degree, no doubt by the strong recommendation of the Chief of the United States Weather Bureau that a meteorologist be included in the United States' delegation. At meetings of the subcommittee on synoptic weather information held in London in June, 1928, a resolution was adopted urging representation of the International Meteorological Organization in the convention and naming the president of the International Meteorological Committee as its representative. This resolution was brought to the attention of the British Government which called the convention and controlled official procedures. The resolution also came to the attention of the officials of the various governments invited to participate in the convention. The position of the British Government was in effect that it could not recognize unofficial organizations but that any government was at liberty to compose its delegation to represent any phase of safety of life at sea it might desire; also, that during the convention advisors outside of the official delegations could be utilized. Three nations had meteorologists in their delegations—Great Britain, Germany, and the United States.

As is customary in international conferences, committees were formed to handle different subjects. The committee on safety of navigation was one of the five

major committees thus formed. The major committees in turn appoint subcommittees. Meteorology came within the scope of the committee on safety of navigation and was the first subcommittee to be formed. Each nation had the privilege of naming a member. It was expected that the subcommittee would be small but the actual number was 19, representing Italy, England, France, United States, India, Australia, Germany, Russia, Netherlands, Norway, Denmark, Canada, and Japan. The subcommittee was augmented by Colonel Gold, of the British Meteorological Service, and Captain Bureau of the French service by special designations of the chairman of the delegations of their respective governments. These facts are mentioned to indicate the recognition given to meteorology in the 1929 convention in contrast with the convention of 1914.

As might be expected, many viewpoints were advanced by the membership of the subcommittee, all of which required patient discussion and adjustment, but in basic principles there were few divergencies of opinion. Details of the discussions and descriptions of the proposals that were rejected, modified, or accepted, are interesting but it is not practicable to discuss them within the limits of this program.

The committee on navigation accepted the report of the subcommittee with no material modification and by a large majority vote, but strong objection was offered by the Danish delegation to the article which stipulated that instructions to ships concerning meteorological observations should be given by the national meteorological service of the country under whose registry the ships are operating. This clause was lengthily debated and the subcommittee's report was approved with only three negative votes. However, the Danish delegation carried their point in the plenary session.

The 1929 convention as signed is divided into two parts. The first consists of covenant or convention articles and the second of regulations governing procedures in application of the convention provisions. In the 1914 convention meteorology was not mentioned in the convention articles and therefore it had no legal standing. Inconsequential paragraphs pertaining to weather, which were so worded as to place no obligations on anybody, appeared solely in the regulations.

The meteorological subcommittee at London drafted two convention articles, one dealing with obligatory reports to be made by all shipmasters, the second enjoining governments to encourage certain meteorological arrangements of importance to safe navigation. They are, respectively, articles 34 and 35 of the convention.

Article 34 enumerates certain dangers to navigation, which masters are compelled to report under penalty. Dangerous ice, derelicts, and "dangerous tropical storms" are specified. On the other hand, it places obligation on each administration to take all steps it considers necessary to insure that the dangers when reported be promptly

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brought to the knowledge of those concerned and communicated to other administrations interested. This article reads as follows:

ART. 34. The master of every ship which meets with dangerous ice, a dangerous derelict, a dangerous tropical storm or any other direct danger to navigation is bound to communicate the information, by all the means of communication at his disposal, to the ships in the vicinity, and also to the competent authorities at the first point of the coast with which he can communicate. It is desirable that the said information be sent in the manner set out in Regulation XLVI.

Each administration will take all steps which it thinks necessary to ensure that when intelligence of any of the dangers specified in the previous paragraph is received, it will be promptly brought to the knowledge of those concerned and communicated to other administrations interested.

The transmission of messages respecting the dangers specified is free of cost to the ships concerned.

The scope of article 35, as previously indicated, involves moral responsibility and cooperation, rather than compulsion. It is comprehensive and self-explanatory:

ART. 35. The contracting governments undertake to encourage the collection of meteorological data by ships at sea, and to arrange for their examination, dissemination, and exchange in the manner most suitable for the purpose of aiding navigation.

In particular, the contracting governments undertake to cooperate in carrying out, as far as practicable, the following meteorological arrangements:

(a) To warn ships of gales, storms, and tropical storms, both by the issue of wireless messages and by the display of appropriate signals at coastal points.

(b) To issue daily, by radio, weather bulletins suitable for shipping, containing data of existing weather conditions and forecasts.

(c) To arrange for certain selected ships to take meteorological observations at specified hours, and to transmit such observations by wireless telegraphy for the benefit of other ships and of the various official meteorological services, and to provide coast stations for the reception of the messages transmitted; and

(d) To encourage all shipmasters to inform surrounding ships whenever they experience wind force of 10 or above on the Beaufort scale (force 8 or above on the decimal scale).

The information provided for in paragraphs (a) and (b) of this article will be furnished in form for transmission in accordance with article 31, paragraphs 1, 3, and 5, and article 19, paragraph 25, of the general regulations annexed to the International Radiotelegraph Convention, Washington, 1927, and during transmission "to all stations" of meteorological information, forecasts and warnings, all ship stations must conform to the provisions of article 31, paragraph 2, of those general regulations.

Weather observations from ships addressed to national meteorological services will be transmitted with the priority specified in article 3, additional regulations, International Radiotelegraph Convention, Washington, 1927.

Forecasts, warnings, synoptic and other meteorological reports intended for ships shall be issued and disseminated by the national service in the best position to serve various zones and areas, in accordance with mutual arrangements made by the countries concerned.

Every endeavor will be made to obtain a uniform procedure in regard to the international meteorological services specified in this article, and, as far as is practicable, to conform to the recommendations made by the International Meteorological Organization, to which organization the contracting Governments may refer for study and advice any meteorological questions which may arise in carrying out the present convention.

The regulations article in the 1914 convention was discarded by the subcommittee because it was long, complex, impracticable, and had never been brought into general use. The new regulation (Regulation XLVI) prepared by the subcommittee was adopted as presented. It deals entirely with details of procedure on the part of shipmasters in reporting "dangerous tropical storms," and other dangers to navigation, as required by article 34. It is as simple and as short as possible consistent with supplying instructions which will enable shipmasters to prepare in a uniform manner the dangers which they are compelled to report.

The complete convention, in English and in French, has been published by the Department of State and may be obtained by purchase from the Superintendent of Documents, Washington, D. C.

At this time (May 1, 1930), the convention has been formally adopted by a considerable number of the participating governments. It has not yet been considered or ratified by the United States Senate.

The significance and importance of the London convention will appeal at once to meteorologists. It was epochal. Undoubtedly it will be of incalculable benefit to the future standing and progress of meteorology. For the first time this science and service was given recognition in an international agreement; for the first time official recognition was given by governments to the International Meteorological Organization. The convention has advanced the influence and standing of that organization to a position which will make it a potent factor in strengthening and stabilizing working arrangements among the national meteorological services of the world. In this connection it is pertinent to remark that for many years prior to the London convention there was no lack of cordial cooperation and understanding between the meteorologists of the world, even during periods of stress and national enmities caused by war. There has never been any need for peace conferences among national meteorological services; but there has been and always will be necessity for frequent meetings to work out uniform methods of procedure and adjustments of service.

The second conference of prime importance to meteorologists was the sexennial meeting of the International Meteorological Organization held in Copenhagen, Denmark, in September, 1929. Prior to its sessions the various commissions of the organization were held in the same city. Incidentally it may be mentioned that during the summer the British Government had called together in London all of the directors of the meteorological services in its dominions. Although this conference was British in its scope, and its accomplishments not of direct concern to other nations, it had important bearings on the Copenhagen meetings because most of the attendants also went to Copenhagen and participated in the meeting of the commissions and the organization.

INTERNATIONAL METEOROLOGICAL ORGANIZATION, COPENHAGEN, 1929

The International Meteorological Organization meeting at Copenhagen was the most representative one ever held. Never before had so many of the workers in meteorological science come together. Thirty-four countries were represented and about 40 independent services, the number of delegates, commission members, and allied participants being 93. Germany had 16, England, Sweden, and Norway had 5 each, Japan and Spain 4 each, while the other countries were represented by from 1 to 3 each.

The International Meteorological Organization is not exclusively meteorological in character. It embraces other subjects such as terrestrial magnetism, atmospheric electricity, hydrology, etc. All of the commissions, 12 in number, held meetings during the week preceding the session of the parent organization. The sessions of the latter in the main were devoted to consideration of the reports of the commissions. The International Meteorological Organization meets every six years, but many of the commissions meet more frequently so that all of their actions and resolutions during the 6-year period since the conference held in Utrecht in 1923 required action.

Discussion, even in abstract, of the proceedings at Copenhagen would require more space than is practicable here. A full report will be published and become available to those interested in the whole proceedings or special portions thereof. Therefore, remarks will be confined to a few outstanding accomplishments.

For many years there has been general recognition of the necessity for organizing ship reporting service on a uniform basis. Every maritime nation has been proceeding along lines of individual organization, employing codes of its own, securing data according to its own ideas of necessity, and arranging for collections best adapted to its own communication facilities. The problem of international coordination of ocean service was discussed at subcommission meetings held in Paris and London in 1928. These meetings were attended by the Chief of the Weather Bureau and the Chief of the Forecast Division. The conclusions reached, in the form of 12 resolutions, were adopted without material change at Copenhagen. These resolutions, in substance, provide—

That each nation shall arrange with a certain number of selected ships to take standard observations regularly, the number of selected ships to be equitably distributed among the nations according to tonnage.

That the standard hours of selected ship observations shall be 0000, 0500, 1200, and 1800 G. M. T., and that when only two observations a day are transmitted the preferred hours will be 0000 and 1200.

That adequate facilities be provided for exchange of ship observations among the meteorological services requiring them.

That a universal code be employed.

That, pending international agreements regarding nonselected ships, no restrictions will be placed on any country in providing service from such ships to meet domestic requirements or in the transmission of reports therefrom in either plain language or in any published code.

NOTE.—This provision was designed to prevent interference with service such as the United States has in connection with its hurricane warning work.

That encouragement be given to the establishing at the Azores of a collecting center for ship reports in the North Atlantic and for forecasting service.

NOTE.—The Portugal Government already has erected a radio station at the Azores and has begun collecting ship observations.

That all arrangements relating to ships and ship observers shall be a national procedure through the meteorological institute of the country under whose registry the ships are operated.

Concerning the foregoing, it may be said that the United States Weather Bureau already has begun its selected ship program, that 20 selected ships of United States registry are reporting regularly; and that on May 1, it put into use on such ships the universal number code as adopted at Copenhagen. A detail of this program is that selected ships, regardless of nationality, in the North Atlantic will radio their reports to Washington when west of longitude 35°, and to the Azores or some other selected European station when east of 35° longitude. Already 20 United States ships, 32 British ships, and 5 French ships are radioing their observations to Washington. It is expected that in a few months 10 German ships will come into the program. All of these messages are included in the bulletins that are transmitted twice daily (11 a. m. and p. m.) from the Weather Bureau, through Navy radio station NAA, for the benefit of the European meteorologists. However, arrangements for United States ships to transmit reports to Europe when east of 35° longitude, have not been completed due to some pending questions pertaining to radio tolls.

An outstanding accomplishment at Copenhagen was the agreement reached pertaining to international codes. This is a matter with which national services struggled

for many years. The problem had many difficult angles, some of them appearing to be impossible of adjustment. Every nation has its peculiar situations of public service which require that data be supplied in certain forms of substance and arrangement. This problem was particularly acute among European countries because of their relatively small geographic areas, their dependence on each other for observations, and the necessity for coordination of communication arrangements so that weather reports could be made quickly available without sacrificing data that each desired. Transmission in code is necessary, because plain language would produce a volume that would choke communication facilities. A number code in groups of 5 is best for the purpose. It is believed that now this opinion is universal.

Securing agreement as to form of the codes and of the data to be universally utilized was not so simple. For instance, some were satisfied with a few cloud types, others wished a hundred. The requirements of some were satisfied in expressing state of weather in a few terms, such as clear, cloudy, raining, snowing, etc., while others insisted on divisions of a hundred parts. Similar complications and viewpoints were numerous. Other technicalities involved arrangements of the data in the number groups and the arrangement of the groups in the messages. This perplexing problem came within the purview of the commission on synoptic weather information, of which Col. E. Gold, of the British Meteorological Service, has been president for many years. It was due in large part to his skill and tact that the code question was amicably settled at Copenhagen. Forty-eight symbols, subject to a few modifications, and 22 data tables applicable to the code symbols and arrangements were adopted. This year for the first time in the history of international meteorological relationships a common code for use in international work will come into use. It stands out as one of the great accomplishments at Copenhagen. No longer will a ship captain be required to consult a volume of hundreds of pages in his efforts to decode a weather report handed to him by his radio operator. No longer will an airship circumnavigating the world, as did the *Graf Zeppelin*, have to carry over 30 weather-code books in order to prepare weather charts. Hereafter, one code book will suffice and not be a very large one at that. Every figure in the code will have a precise meaning and the same meaning regardless of the ship or country from which an observation emanates.

Another important decision related to units to be used in expressing barometric pressure. Inches and millimeters gave way to millibars. In the future millibars will be used in all international transmissions. Temperature did not fare so well. No universal unit was adopted. Centigrade and Fahrenheit scales will continue in use according to national preferences.

Another important accomplishment related to international collecting and distributing weather reports. The conference remarked that five great wireless transmissions of a character peculiarly international are required under present conditions for synoptic meteorology of the Northern Hemisphere, and that there are five nations in a specially favorable position for the collection of the information required and their transmission to meet international requirements. They are: France for Western Europe; Germany for Central Europe; Russia for European and Asian areas under Russian control; England for collective transmission to America of reports from the eastern Atlantic and Europe; and United States for collective transmission to Europe of reports from the western Atlantic and North America.

The conference expressed the hope that the meteorological services of these five countries would be able to undertake the services mentioned in the interest of meteorology in the Northern Hemisphere.

For several years past the United States Weather Bureau has been doing what was allocated to this country in the form of the so-called Angot broadcasts at 11 a. m. and p. m., E. S. T. Therefore, no material change in its program will be necessary. France has been transmitting for the benefit of services on this side of the Atlantic a bulletin (once daily) containing European reports. When the suggestions of the conference are complied with, England will take over the duty of transmitting European reports to America, relieving France of the obligation. These arrangements are now under way and it is expected that they will be put into effect within a few months.

In all, there were 109 resolutions adopted at the Copenhagen conference, covering a wide range of activities. All are important, but it has been practicable to refer only to a few which appear to have the most direct bearing on our own activities.

The by-laws or operating rules of the International Meteorological Organization were changed in several important respects. Some of the principal changes are:

Provision for a permanent secretary whose salary will be paid from contributions by the various services.

Provision whereby a director who is unable to attend a called meeting of directors may name a representative, but such representative must be an official of the service that he represents or else a former director thereof.

Location of the permanent headquarters of the secretary in Switzerland after the ensuing 6 years, the office to remain in Holland until that time.

The creation of an executive council of 5 to handle administrative details of the organization in place of the former cumbersome method of referring questions to the International Meteorological Committee (about 20 members) scattered in all parts of the world. The executive council appoints the personnel of the Secretariat and controls its budget and activities. The Chief of the United States Weather Bureau has been elected a member of this council.

NOTES, ABSTRACTS, AND REVIEWS

Weather forecasting from Synoptic Charts by Alfred J. Henry.—The present is the second in the series of Weather Bureau publications on this subject. The first one, *Weather Forecasting in the United States*, issued in 1916, is out of print. The method of treatment in the present work differs somewhat from that followed in the first of the series. The subject, as every one knows, is difficult of treatment because of the limitations in size and the number of the charts that may be reproduced. The first work contained about 160 charts, the second has but 23 but with these last-named are presented the daily forecasts for each State in the Union together with a statement of the guiding principle, or principles, in mind in each case. No doubt the average reader would like to have had these principles developed at greater length, but to have done so would have made the publication interminably long and wearisome in the reading. The aim has been to give just enough of a suggestion for the groundwork of the forecast to excite the curiosity of the reader for more, in the belief that it is only by intensive study of the problem that a clear understanding will be reached.

There is included in the publication a brief history of the beginnings of weather forecasting in this country, thus filling a gap in the history of the Federal Weather Service that would be difficult to supply in future years.

The publication the full title of which is *Miscellaneous Publication No. 71, U. S. Dept. Agri.*, can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the price of 20 cents the copy.—A. J. H.

*P. R. Gast on a Thermoelectric Radiometer for Silvical Research,*¹ review by H. H. Kimball.—The author lays down the following requirements:

1. It should be sensitive to radiation between the limits λ 0.29 μ to 2.5 μ , which embraces practically the entire wave-length range of energy received at the surface of the earth from the sun.

2. It should be capable of measuring radiation intensities over the wide range from the lowest intensities in the forest to full sunlight.

3. The sensitivity must be inherent in the instrument, which must be fully and equally sensitive to rays coming from all directions, or it must be possible to amplify the registration.

4. It must be nonselective for different wave lengths.

5. The readings of the instrument must be capable of being expressed in terms of fundamental units of measure, such as gram-calories per unit of area and time.

6. It must be possible to use the radiometer with a recorder of simple and rugged construction.

After trying out 11 devices using different types of receivers and methods of temperature measurements, it was decided to use the nonselective heating method and to register the temperature changes by means of thermoelectric effects. The spherical hot-junction thermopile was found best adapted to the requirements specified in paragraphs 1 to 6, above.

In the illustrations of this thermopile, given in the paper, there are five spherical hot junctions consisting of nickel-silver beads 0.1 inch in diameter to which constantan and iron wires are spot welded. The cold junctions are disks of pure nickel 0.2 inch in diameter and 0.02 inch thick to which the thermocouple wires are also spot welded. The cold junctions are shielded by mounting them between annular shields of mica, which are blackened on their inner surfaces but bright (or white) on their outer surfaces. The hot junctions are coated with lampblack. The thermopile is then mounted on the stem of an electric lamp, baked in an electric oven, and sealed in an evacuated electric-lamp bulb. Thus mounted the iron wire does not rust, and the durability and sensitiveness of the thermopile is greatly increased.

It was customary in field work to connect three of these thermopiles in series at each point where measurements were desired and connect them with a recording galvanometer capable of recording the indications for four different points or stations on one record sheet.

Discussing the thermopile data for the year 1925, the author remarks:

In the first place it may be noted that the maximum total daily values are obtained in July and August. This is not in accord with the calculations of Kimball (1919) whose data indicate the probability of maxima in May and June. The explanation of the difference is apparently due to Kimball's use of vapor pressure

¹ A Thermoelectric Radiometer for Silvical Research, by P. R. Gast. Harvard Forest Bull. No. 14. 76 pp. 25 figs. Harvard Forest, Petersham, Mass. 1930.